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ABSTRACT

Recent developments in the field of computer communication are reviewed, and ways in which these technologies can be used to make anthropology more productive and effective are examined. Computer communication is defined as the communication of symbolic information from one location to another electronically over phone lines, satellite links, or microwave links. Hardware discussed includes national and local area networks and microcomputers. In the software category, electronic mail and bulletin boards are discussed, online information retrieval services are examined, and software programs provided by national microcomputer utilities are described. Demographic aspects of anthropology that tend to increase the usefulness of computer communications in the discipline are outlined: (1) anthropologists working on the same things tend to be isolated in relatively distant locations, and (2) anthropology needs a communication system that can cross cultural and national boundaries. Also described are applications of computer communications to anthropology, including person-to-person data exchange, electronic mail, computer conferencing, electronic publishing, electronic data sharing, and cross-cultural communication. (RM)

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COMMUNICATIONS AND CONFERENCING SOFTWARE FOR ANTHROPOLOGY

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Introduction

If the humanities and the social sciences are going to compete as information sources with other sciences, they ought to avail themselves of the information processing technologies that are now appearing. Digital computer technology has been a major contribution of American engineering to world technological development over the last twenty years. Instead of occurring sporadically, as is usual in almost any other area of technology, progress has occurred, and is continuing to occur, at a steady unrelenting pace with no end in sight. This steady multiplication of information processing technology poses a challenge to anthropology and other social sciences. This article is an effort to review some of the recent developments in the field of computer communication and then to explore how these technologies are being used, and can be used, to make anthropology more productive and effective.

Computer communication, or data communication as it is more commonly called, is the communication of symbolic information from one location to another electronically over phone lines, satellite links, or microwave links. As computers invade our lives the potential for them talking to each other and to humans at remote locations increases.

In data communication technology, symbols are represented by a sequence of on-off, binary, signals that are sent out one by one at a quick rate over a communication line, which in it's simplest form is just a pair of wires. The rate at which the binary signals, bits, are sent is called the baud rate, and is given in bits per second. Usually the communication is simultaneous two-way communication, which is called full-duplex communication in computereese. In full-duplex communication the computer can send to the user at the same time the user is sending to the computer. If wires are used, this requires two separate pairs of wires. There is a present de facto international standard for converting Roman letters, accents, and a few other symbols, into groups of binary signals. This is called the ASCII (American Standard Code for Information Interchange). The symbols are coded into 7 binary bits which makes 128 different symbols available. Microcomputers often are able to add an eighth bit by dropping a parity, check, bit and by doing their checking in another manner. Thus 256 characters can be sent with standard hardware today, but there is no agreed on interpretation of the extra 128 characters. The ASCII system is a blessing in that practically all machines from terminals to giant computers use it for their serial data communication now.

Normally, a telephone network is used for much of this communication, and this requires that the binary signals be modulated on some sort of carrier, usually an audible tone, the steady beep that you hear when you call a computer on the

telephone. The tone shifts up and down according to the binary signal, zero or one, that is being sent. Telephone communication therefore requires that a modulator-demodulator, or modem for short, be placed between the equipment and the phone line. With a modem and a computer terminal you are ready to talk to almost any computer on the telephone, and it is becoming easier and easier to do this. The typical computer reachable by regular phone lines communicates at a rate of 300 or 1200 baud, and usually both.

The mechanisms required to process data are conventionally separated into two groups: hardware and software. Hardware are those physical devices that switch electronic currents at amazing speeds. If you take the top off your computer you can see the hardware in the form of integrated circut chips soldered in great numbers to printed circut boards. The software mechanisms you can't see because they exist only as programs in the hardware memory units. Programs are numbers that are interpreted by the hardware as instructions for doing something. The hardware is pretty dumb without the programs to tell it what to do. Hardware is called such because it can't be changed by the user. Thus, it is "hard." Software is soft because it can be changed. Computer communication, like all data processing, requires both hardware and software. In the complicated world of communicating computers, the user may not be able to change the programming of intermediate data-passing computers whose actions are routine. Thus to common users much of the engineer's "software" may look

like hardware, because the common user can't change it. Our definition of hardware will be the common user's definition, and we will discuss it first.

Hardware

Networks

The June 1983 on-line directory of international services of Tymnet, one of the large data networks, said: "TYMNET can be accessed with a local telephone call in 33 countries in North and South America, the Caribbean, Europe, the Near and Far East and Oceania. TYMNET's sophisticated software interconnects over 260 U. S. and non-U.S. metropolitan centers and their outlying areas (TYMNET 1983:1)." This is just one illustration of the dramatic increase in computer communication technology that has occurred over the past few years. Computer networks, which should properly be called "packet switching networks," are just one part of this technology. At present the globe is encircled by satellite and land-based microwave communication systems that can carry computer-readable information from one part of the world to another in a fraction of a second. Furthermore, access to these systems is easy to get, and the price of using them is getting less and less. They are now and will be for a long time to come

the cheapest method of instant communication in existence. For example the price to communicate from the U. S. with a computer in Austrailia over Tymnet is now $12.00 per hour and 60 cents per kilocharacter. This, you will note, is far less than a long distance telephone call. How do these networks such as Tymnet, Telenet, Uninet, CompuServe, and others work, and how can they be put to use in anthropology?

There are now three large public packet switching networks in operation in the United States. They are called Tymnet, Telenet, and Uninet. More are likely to appear with the relaxation of restrictions on competition between communication companies. The packet switching technique was originally developed for ARPAnet, a Department of Defense computer network. To use one of these networks, the user dials a local phone number in his area. His terminal is connected to a node in the network, and the user then gives the network the address of a host computer connected to another node with which he wants to communicate. The network itself is controlled by communication computers. The network figures out a path from node to node between the user and the host, and then establishes this as a virtual circut during the communication session. Data is divided into packets and addressed according to the virtual circut established. The virtual circut technique used by the public networks saves time and cost over the original ARPAnet technique in which each packet carried the full address of the host or user. The network handles thousands of packets each second

belonging to hundreds of communication circuts and traveling in many directions from node to node back and forth from hosts to users. By sending the packets at high speed, and by interspacing packets from many different circuts, the network is able to take maximum advantage of the satellite and ground-based communication channels that are dedicated to its use. The disadvantage of the virtual circut technique is that if a link between two nodes goes down, the packets are not instantaneously switched around the break to provide uninterrupted communication. The link has to be re-established by the user once it has been broken; however there are considerable savings in cost in the virtual circut technique. Also, as users may have noticed, if many packets are being handled by the network, the response from the host may be delayed.

A new development in network software is underway. Software for the network computers is being developed so that they can be reprogrammed by the interacting computers. This is resulting in what has been called the "intelligent network" (Latamore 1983). In the midst of a communication session, an intelligent network can change the virtual circut so that the user starts to communicate with another computer that is called in by the original host. Thus if one computer is not able to serve the user, it can call up another computer with the correct programs or data and alter the communication paths so that the user starts to access the new computer. This can take place so quickly that the user need not even know that he is communicating with a new

computer. Thus a problem can be dealt with by a team of computers interacting with the user over an intelligent network.

Microcomputers and Local Area Networks.

The local area network is a new development that is simply scaled down version of an international network. It can connect, let us say, microcomputers on a college campus. Each microcomputer has the capacity to send and receive data to and from the others. Such systems are software limited, and at the present limit of technology, give each microcomputer access to the public files of another. Of course one has to keep his or her microcomputer switched on for another one to access its data. Although the steam for this development is coming from corporations and other bureaucratic organizations who want to speed up the delivery of electronic mail, their applications to research organizations and universities should be obvious.

The microcomputer itself is rapidly evolving as a communication machine. We now have suitcase-sized and breifcase-sized portable microcomputers that can be connected to ordinary telephones to pass and receive data to other systems. The main problem inhibiting all computer communication is communication control software.

It is easy to get a microcomputer to imitate a computer terminal. It is much more difficult for it to coordinate its

communication with another computer so that large files of data can be sent and received directly to and from the disk memories of the two machines. Transferring and checking data is most easily done when the program receiving and storing the data can be sure of exactly how the data is going to be sent by the sending program. A system by which the receiving computer knows what the sending computer is doing is called a communication protocol. Unfortunately there are no universally accepted communication protocols, and the software implementing such communication can be complicated. Microcomputers are being advertised these days as being able to communicate with other computers, but often, when finally purchased, they are deaf and dumb, because no one has taught them how to talk. The confusion of microcomputer error-checking protocol-dependent communication software is very disturbing and is limiting the usefulness of microcomputers as communication machines. At present, it seems that users have to go through the difficult process of finding a program that will work both on the machine with which they want to communicate and on their microcomputer too. A far from trivial problem is how do you transfer a program for transferring programs if you do not already have a program for transferring programs. People in a large university environments may get help from their respective computer centers with this problem; however the university environment has spawned the development of awkward, complicated, totally non-standard communication systems which may be very difficult to understand (Oberst 1983:7-8).

The ease of computer communication over phone lines is being increased and the cost of such communication is being reduced, by integrated circut development. Already serial ports are available in single chips and recently entire modems have been appearing on single chips. In a year or so most microcomputers will be sold with integrated circuts enabling them to be plugged directly into a phone line.

Software

Electronic Mail

The most elementary computer communication system is electronic mail. Electronic mail works like telegrams that are left in the computer to be picked up when the addressee calls into the computer. They can be read only by the person to whom they are addressed. The great advantage of electronic mail is its speed. The message is delivered the moment it is composed. Some electronic mail systems deliver the message line by line, which can get to be confusing if the addressee starts to respond to the message before it is completely sent. Sophisticaed electronic mail systems provide for multiple addressees, forwarding, "carbon" copies, storage bins for old mail, subject

titles, and searches among other things. A number of information utilities have these systems: CompuServe, The Source, and BRS-After Dark. Networks such as Tymnet, and Telenet also offer electronic mail.

Bulletin Boards

Bulletin boards are electronic mail systems in which all messages are public. The software is not complicated and is available on most microcomputers. It is likely that there are a number of privately run bulletin boards in your city. They have names like ABBS, CBBS, CONNECTION-80, etc. Much of the software is set up for particular microcomputers, the vendors of which hope that the bulletin boards will increase the interest in their machines. Most of them at present are run by computer enthusiasts for their own benefit; however a number of more professional ones, for example for teachers, are beginning to appear.

A user has the opportunity to read all the messages that have been posted and t post any of his own. Most bulletin boards have enhancements to make them more useful: a private message system, a means for searching for words in a label, etc.

National Microcomputer Utilities

Many people have now heard of "The Source" and "Micro Net." These are large collections of software run by large computers connected to packet switching networks that cater to individual non-corporate users. For a modest fee they will let you use their computer for all sorts of things. In fact they try to make it convenient and attractive to do so. One can play games, get the news, analyze stock reports, swap info with other on line users, send and receive computer programs, and communicate with like minded hobbyists. In spite of many frivolous services, these utilities can offer professionals low cost electronic mail and conferencing. Although their software is unsophisticated and geared for a mass appeal, their prices are right. CompuServe, which used to be known as MicroNet, will sell its evening services which include mail and conferencing for $6.00 per hour. Thus one does not need grant support to keep up with casual conferencing and information exchange. The remainder of the hundreds of services, stock market analysis, weather reports, program exchange, are not particularly valuable to anthropologists, although some such as news searches may be useful at times.

On-Line Data Banks

More useful to professional social scientists are the big bibliographic data banks such as Dialog, BRS, and ORBIT. These started out as bibliographic data banks but now are adding other sorts of data: newspaper files, business directories, financial reports, and employee resumes. The thing that they do best, however, is still finding journal articles.

You don't have to go to your librarian to use these services. You can sign up with them yourself. The great advantage in doing bibliographic searches yourself is that you know better than anyone else what you are looking for, and, when you get a partial scan of available information, you can alter the search strategy immediately to get what you want rather than what the computer thinks you should have. Dialog also has dozens of automatic ordering services that will deliver copies of almost any article in a few days. These services are invaluable for serious research. Several years ago the point was passed where these systems made available more bibliographic information than any library in the world. Now they are superior. The problem with them is their cost. They are good. They know it, and they charge for it. Prices will average around $70 per hour. Fortunately the business services tend to be on the high end and the social sciences tend to be on the low end of the price scale. On Dialog, for example, the document delivery services are run by 71 independent companies worldwide that receive the orders from the central computer and process them at major U. S. and foreign libraries.

Conferencing systems

A number of computer utilities now exist that allow users to conduct computer conferences. Perhaps the most well known one is the Electronic Information Exchange System (EIES) created by Murray Turoff at the New Jersey Institute of Technology. A conferencing system is one step beyond the bulletin board concept. Each participant communicates with a central computer. A conference develops around a sequence of public messages, readable by all the participants. Each participant reads the latest public messages and adds new ones of his own. The difference is primarily one of intent. The conference addresses a particular topic, issue, or task. There is a conference leader who stimulates the discussion, proposes agenda, and summarizes the proceedings from time to time. Special software aids this work. A mechanism for indexing later references to earlier entries is provided, so that chains of related comments can be picked out. Some systems provide a way of subdividing the conference as it develops in different directions. A conferencing system will also provide personal electronic mail, a large set of information documents, indexes of conferences and conference subjects, and an area of the computer for storing long texts which may become the subjects of discussion. Conferencing systems are being developed for many large computers at the

moment.

Computer Communications in Anthropology

Computer communication can be used by anthropologists to make much of the work they do more effective. Two demographic aspects of anthropology tend to increase the usefulness of some of these techniques: first, anthropologists working on the same things tend to be isolated in relatively distant locations; second, anthropology is world-wide and needs communication that can cross cultural and national boundaries. Several present and potential applications of computer communications to anthropology will be discussed in the following sections.

Person to Person Data Exchange

It is possible for two microcomputers to exchange data over the phone lines. If two persons at distant locations are working on a joint publication or on special data, their microcomputers can send their latest work to each other where it can be changed or added to. The best way to do this is to have one computer call the other computer late at night when the phone rates are low. Files can be transferred automatically, and the persons will wake up with copies of their partners previous day's work in

their computer files. Sophisticated CP/M computers have this sort of software operating at the moment.

Electronic mail

Another way of doing this sort of thing is to use an electronic mail system. It is better for anthropologists to use the electronic mail systems attached to conferencing systems and information utilities rather than those provided by the networks. The networks systems are more expensive and cater to business customers who want rapid delivery and a large subscriber base. In many cases anthropologists would rather send a large block of information in a day at a cheap rate than send a small amount of information in an hour at an expensive rate.

The rationale for anthropologists in using computer communication is often not that the information itself is current, as it might be in business or government, but that the quick reaction of a colleague is desired.

If a central computer is available for exchanging information, the possibility of working jointly on the same paper or on the same data exists. The major impediment here is cost. Time to connect to a distant computer while doing simple editing can add up. A good way to save money is to do the editing on a microcomputer and then to transmit this section to the main computer when it is ready. Software may, or may not, be

available to do this for a particular microcomputer and a particular main computer. The area of micro-main computer communication is still in need of much development.

Computer Conferencing

Computer conferencing is useful for some things and not useful for others, which might seem at first to be profitable. One must keep in mind that computer conferences take human time as well as computer time. Both can be costly; therefore it is wise to use computer conferences for the tasks that can best be accomplished by them. Computer conferences have a speed of information exchange somewhere between the exchange of papers by mail and a direct face-to-face conference. One of the great advantages they have is that one can retire to think about a subject, and yes even visit a library to read about it, before responding to an issue. However this can often produce a digression from the original purpose of the conference into subjects that seem more attractive.

Computer conferences are useful when two or more colleagues have to put their heads together and come up with some good ideas in a limited amount of time. They work best when there is a strong group commitment to a goal and a sharp division of labor. Computer conferences seem to work well for: (1) planning face to face conferences, (2) planning a publication or project, and (3)

jointly writing grant applications. Depending on the funds available they may, or may not, be good for joint paper writing. They do not seem to be a very good means of disseminating and commenting on papers, because of the volume of typing that is required to enter the document. However with cheaper communication and with better software for transferring texts from microcomputers, this might be more feasible.

Electronic Publishing

So far the idea of electronic publishing has not been realized in any practical sense. What is being envisioned is the full on-line availability of scientific papers. The computer memory capacity and communication hardware are becoming available; however there are some practical considerations that have to be kept in mind.

Scientific papers have a long lifetime and a small readership. In this way they differ considerably from news items which have a short lifetime and a large readership. Thus the speed of access to the papers is not as critical, while the per-user cost of publication may be larger. What keeps the cost of scientific publishing down is that no one expects a profit from it. The economics of scientific publishing is quite different from that of popular publishing.

However there are a number of very attractive features of

electronic publishing that cannot be realized by paper publishing. These are: greater accessibility, the capacity to search the information rapidly, and immediate availability. Practically any anthropologist in the United States can now get hold of a computer terminal and learn how to use it. The availability of computer terminals is now probably greater than the availability of good libraries. These advantages seem to be sufficient to make electronic publishing a good idea, especially for a small group of scientists like anthropologists.

The problems of electronic publishing are primarily the costs in human effort and in computer and communication hardware. If each author became responsible for entering and editing his or her own contribution, the labor of publication preparation would be much less. Editors would still have to do their work, but they would work more like newspaper editors, all of whom now deal with articles in electronic form.

Let us look at some figures that tell us about the memory and hardware problems. There are presently 5768 degree-holding anthropologists employed in academic settings in the U.S. and Canada (American Anthropological Association 1982:413). If all these people contributed three papers of 50 manuscript pages apiece per year to the literature, a single computerized publication system would have to deal with about 1.3 x 10**9 characters of information per year. This is a horrendous amount of information for today's computers to handle. It would require the expenditure of over a million dollars per year to expand the

computer memory. Perhaps the volume of verbage would eventually overload the system. The problems of load on the communication network are less. If each user read 100 pages per week from the system in addition to what he or she wrote, they would be connected to the system for about 20 minutes per day, assuming all transfers at 300 baud. This would impose a load on the system of 1.27 x 10**8 characters per day, which is more bearable than the cost of computer memory. And, these technological considerations may be small in comparison to the social problems unleashed by undermining the prestige structure of publication in restricted journals.

If anthropology is to realize the advantages of electronic publishing it will have to either computerize a small portion of the total papers or publish only a bit of each, that is an abstract. The publication of just the abstracts makes much more sense, because the search advantages can still be realized. Most modern information banks utilize just abstracts. Since the connections between readers and writers will not be great, the final document or paper could be sent by regular mail, perhaps with a request command built into the searching computer.

A practical electronic publishing scheme would look something like this. A central computer connected to an international packet switching network would be the host. Users would enter abstracts in standard format of papers which they have written. A search system based on words and combinations thereof would be available. Upon locating an abstract a user would enter a simple

code which would notify the author that a copy was desired. At this point the user could be billed a royalty fee. It would be the responsibility of the author or a service group to mail the user his copy of the paper. This scheme is not a new one. It is essentially the same as the one that is being presently used by the Dialog search system, which is doing very well as a profit-making enterprise.

The possibility of having computer searchable articles on-line may be increased by the new laser-written permanent disks. The potential data storage on a disk of the kind that is now being sold for digitally-readable music is in the billions of characters.

Electronic Data Sharing

Another prospect is the electronic sharing of data rather than the sharing of final publications. The remote access of various codings from the Human Relations Area Files is already an actuality. Any university with codings can make them available to remote users. Perhaps what the future might bring is the team use of data from single or related studies. A group of anthropologists who had an interest in each other's data could record all of this electronically, preferably while in the field, and then make it available to each other while the data analysis was in progress. It could be quantitative data or qualitative

data that was indexed. Field computers should cause an increase in this kind of data sharing. The software that would be necessary is a standard data-base system for team anthropology that would make the exchange and sharing of the data easier at a later date. If such a data base was developed one might look forward to secondary ethnography, ethnography performed on data gathered by another worker. Such possibilities exist in the audio-tape data base mentioned in another paper by the author (Dow 1984).

Cross-cultural Communication

There is also the possibility of using computers for communication directly between informants and anthropologists. This would be a hopeful development. The equipment needs to be provided with user-friendly software. For basic ethnography, the data recorded by informants could be on disks to be mailed in for analysis. Since digital communication is the cheapest form of international communication, ultimately linking the informant to the anthropologist by a packet switching network would perhaps be a reasonable expectation. Before that we can expect to see closer communication being developed between regional ethnic groups and anthropologists in the other parts of the world. Leaders of local ethnic groups or their secretariats could keep in touch with scattered anthropologists via computer

communication.

Some Conclusions

At present the applications of computer communications to anthropology are limited by money and software. The costs are coming down by themselves, but solution to the software problems, many of which are shared with other scientific fields, require also imagination and human talent for their solutions. I see several important tasks ahead.

1. Developing a common protocol for large and small computer communication, that will allow the fast exchange of information between any two machines, without involving the user in complex problems.

2. Developing an ethnographic data-base system for large and small computers that will allow teams of anthropologists to add to and work from a common base of data.

3. Setting up a low cost abstract-type electronic publishing network for groups of anthropologists.

4. Organizing computer conferences around topics adaptable

to this mode of exchange.

5. Getting governments, agencies, etc. to allocate international telecommunication time for group and individual cross-cultural exchanges with anthropological goals.

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Tymnet

1983 International Services Provided by Tymnet, June 27, 1983. :(See access information in Appendix A)

Appendix

Computer Communication Resources

1. Access Information for On-Line Publications

Tymnet publications

First dial a local Tymnet computer node. When asked for your terminal identifier type the proper letter. Most terminals will respond to an "A". After the message "please log in:" type "INFORMATION;;". That is the word "INFORMATION" followed by two semicolons. From then on the system will provide a menu for selecting the various information services. Basic system information can be obtained without charges. The international services directory is in file @INTLPRTCOM.

Bulletin board programs for microcomputers

System name	Microcomputer

CBBS	Various CP/M systems
ABBS	Apple
FORUM-80	Radio Shack TRS
BBS IBM	IBM PC
CONNECTION-80	Radio Shack TRS
NET-WORKS	Apple

Phone numbers for various bulletin boards

A phone book of electronic mail box numbers and bulletin board numbers is available from: Commnet, P.O. Box 706 Charlottesville, Va. 22902.

An updated list of the rapidly changing phone numbers of bulletin boards is maintained by the Peoples' Message System, Santee, CA. Telephone: (619) 561-7277. Source Mailbox: TCB117. CompuServe Mailbox: 70315,1305. This list is available through many local BBS.

Information utilities

Information on the Source can be obtained from: The Source, 1616 Anderson Road, McLean, VA 22102. Telephones (800)

336-3300 or (703) 734-7540 in Virginia.

Information on CompuServe and MicroNet can be obtained from: CompuServe Information Service, 5000 Arlington Centre Blvd., P. O. Box 20212, Columbus, OH 43220. Telephones: (800) 848-8990 or (614) 457-8650 in Ohio.

Information on Dialog, a large bibliographic search and data-bank service can be obtained from: Dialog Information Services, Inc., Marketing Dept., 3460 Hillview Avenue, Palo Alto, California 94304. Telephone: (800) 227-1927. Their cheaper evening service is called "Knowledge Index" and costs $24 per hour.

Conferencing Systems

The Source and CompuServe both offer conferencing systems; however the most sophisticated is the Electronic Information Exchange System. For information write the Computerized Conferencing and Communications Center, New Jersey Institute of Technology, 323 High Street, Newark, N.J. 07102. Telephone: (201) 645-5211. This system is available on Telenet.

Network Information

For UNINET information call (800) 821-5340. For TELENET

information call (800) 336-0437 or if in Virginia call (800) 572-0408.

BITNET is a low cost university-run system interconnecting campus computers around the U. S. Contact Ira H. Fuchs, Vice Chancellor, CUNY, 535 East 80th St., N. Y., N. Y. 10021 and see publication by him.

Publications

Directory of Online Databases

Santa Monica: Cuadra Associates. ((2001 Wilshire Blvd. Suite 305, Santa Monica, CA 90403. (213) 829-9972))

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Inc. ((A monthly magazine. 6531 Cambridge St., Minneapolis, Minn. 55426. Phone: (612) 927-4916. Source: STU329. CompuServe: 72105,1753.))

Today: The Videotex/Computer Magazine

((A monthly magazine published by CompuServe. 5000 Arlington Centre Blvd. Columbus, Ohio 43220. Tel: (614) 457-8600.))